************************************FLIGHT INSTRUCTOR BULLETIN**************************

BULLETIN NUMBER 10

TASK: **Operating a Reciprocating Engine**

SUBTASKS: * General Information

OBJECTIVE: To review information and procedures necessary in the safe operation of reciprocating engines.

STANDARDS: N/A

CONDITIONS: N/A

DESCRIPTION: **1. The Facts**

Several aircraft accidents each year are a result of engine failure or engine power loss. Many of these engine failures may have been prevented simply by better care of the engine. The flight instructor must teach the student the proper aircraft engine operating procedures.

2. General information

A number of precautions must be observed by the pilot in the operation of any reciprocating engine. The larger and more powerful the engine, the more important the precautions become and the more expensive the repair can be if the engine is not cared for.

IMPORTANT:	**The student must be taught the importance of keeping the engine within the operating limitation established by the manufacture. It is essential to monitor the oil pressure and temperature, exhaust gas and cylinder head temperatures, MP, RPM and fuel flow to ensure operation is within limits. Quite often the student may become so fixated on control of the aircraft that checking of engine instruments is**

forgotten.

3. Engine temperature control

A. Teach your students to always be mindful of thermal shock. Thermal shock occurs when engine parts that are operating at high temperatures are quickly cooled. With the cooling comes contraction of the metal engine parts such as cylinders, cooling fins, exhaust ports, etc. This condition can cause cracks and eventually failure of the stressed component(s).

B. Cowl Flaps. Students must understand how and when to adjust the engine cowl flap , if installed. The typical operation of the cowl flap is to stabilize the engine temperature by monitoring the cylinder head temperature**.** Large variances in engine temperature can stress the engine part and eventually leading to failure.

The following is a general procedure for students and flight instructors to follow when flying airplanes equipped with cowl flaps:

a. Cowl flaps should **normally** be opened during engine starting, engine run-up, taxiing, climb, and maneuvers requiring high power settings and low airspeeds. In addition, when training in a multiengine airplane the cowl flap should be used as necessary on the operative engine (normally in the open position) and closed on the inoperative engine during single engine flight.

b. During touch and go operations and go-arounds adjust cowl flaps for adequate engine cooling.

NOTE: For very cold conditions (below 0 °C), consult the Approved Flight Manual (AFM) or Pilot's Operating Handbook (POH) for the appropriate cowl flap operations

c. Cowl flaps should **normally** be closed during cruise, (following level-off from cruise, the cowl flaps should be closed or adjusted as necessary to maintain proper cylinder head temperatures), descent, and a full stop landing following a prolonged descent.

NOTE: Cowl flaps should be adjusted to maintain the cylinder head and oil temperatures within the normal ranges (green arc) specified for the engine. In addition, the pilot must adjust the cowl flaps as necessary to prevent large variations in cylinder head and oil temperatures.

C. Airspeed. Prolonged descends at low power settings can cool the engine below normal operating temperatures. This is especially true in colder climates. In addition, prolonged climb and/or climbs at or below Vy will increase heat. The student should be taught to adjusted power settings or pitch attitude as appropriate to stabilize engine temperatures.

D. Fuel Mixture. The rich mixture cools the engine. In order to aid in preventing detonation, Tetraethyl Lead is added to aviation fuel. Tetraethyl Lead, a heavy, oily, poisonous liquid allows engines to develop more power without detonation, lubricates certain parts of the engine, and helps to cool the engine. However, Tetraethyl Lead can build up to cause spark plug fouling and sticking valves. Therefore, it is very important for the student to understand proper leaning procedures. Because of time and opportunity, many flight instructors do not bother with teaching this procedure.

E. Power settings. High engine power settings increases the amount of heat which must be removed by engine cooling components. Excessive engine heat is undesirable because it weakens and shortens the life of the engine, it reduces lubrication, and causes premature combustion leading to detonation. If high power setting are to be used, the student must be taught how to increase engine cooling (enrich the mixture, increasing air flow through the cowling, etc.)

F. Servicing the aircraft. Students should be instructed on the proper servicing procedures. Many students operate rented aircraft that are cared for and serviced by the owner or ramp personnel. Because of this the student may not learn how to service the airplane with fuel and oil. The flight instructor is responsible to teach the student the various types of oil and fuel that may be used in the aircraft. In addition, the student must understand the purpose and function of engine oil.

G. Use of Engine controls. The flight instructor must teach the student to make throttle, propeller RPM, and mixture control changes **slowly and smoothly**. Flight maneuvers such as touch and goes, go-arounds, simulated emergency approach and landing makes this most critical. Quick movements of the engine controls imposes unnecessary stress on engine parts and is usually an indication of an inexperienced pilot that has not learned to anticipate when and how to make engine control changes.

NOTE:	**When teaching a student, it is important for the flight instructor to place as much emphasis on the smooth operation of the engine controls as would be placed on the flight controls.**

IMPORTANT:	**During a prolonged power-off glide such as a simulated emergency approach and landing, the flight instructor needs to periodically advance the throttle to a medium power position for a few seconds to warm the engine, keep the spark plugs from fouling, and keep the exhaust warm so carburetor heat would be available if needed.**

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